

Power Electronics for Solid Oxide Fuel Cells

Don Adams
Oak Ridge National
Laboratory
Power Electronics & Electric
Machinery Research Center
2360 Cherahala Blvd.
Knoxville, TN 37932
(865) 946-1321
adamsdj@ornl.gov



Don Collins
(304) 285-4156
donald.collins@netl.doe.gov

Objectives

- Address technical barriers for solid oxide fuel cell power electronic systems so that the program objectives of cost, reliability, and performance can be met to facilitate field tests in 2006.

Key Milestones

- Collaborate with NETL and SECA to promote the resolution of technical barriers.

Approach

Tremendous advances have been made in power electronics technologies in the last few years, providing for new approaches to energy generation and use. However, even as better devices, packaging, and manufacturing processes come along, power electronics systems remain short of goals for reliability, performance, cost, and lack suitability for some applications. A number of these issues are critical technical barriers, specific to solid oxide fuel cell applications.

Power electronics is becoming a pervasive embedded technology as technological and manufacturing capabilities rapidly advance. While this evolution is of great value to the Fossil Energy program in solid oxide

fuel cells, the several working sessions held in association with the Solid State Energy Conversion Alliance (SECA) have brought forth a number of shortcomings and technical barriers in the area of power electronics that must be addressed to ensure program success. These issues relate to the development of standards, engineering design, and fundamental research. As power electronics increasingly become a part of many DOE programs, the fuel cell community has not yet taken full advantage of accomplishments coming from other R&D interests. Further, even if the other programs are completely successful and result in commercially available power electronics for other applications, there will remain unsolved issues that are specific to solid oxide fuel cells. The approach discussed here takes advantage of crosscutting developments in power electronics while ensuring the specific needs of fossil energy are met.

Oak Ridge National Laboratory's Power Electronics and Electric Machinery Research Center (PEEMRC) is intimately involved in the power electronics programs of the Vehicle Technologies and Power Technologies Offices of DOE as well as other federal agencies and industry. PEEMRC is in a unique position to assess new developments and research programs to preclude duplication of effort, determine where the needs of Fossil Energy are not being met, and plan and suggest work necessary to meet those needs. PEEMRC will assess the specific power electronic needs for solid oxide fuel cells and evaluate how existing and expected near-term power electronics technologies meet those needs.

Results

Acting as a liaison for NETL, ORNL has provided staff to support the Core Technology Program in power electronics. This is a relatively small effort, but has yielded successes through leveraging other federal programs and the efforts of industry in SECA. Several workshops were held with good participation. NETL is supporting the Future Energy Challenge by providing a

cash award for the winning university students who are designing and building power converters for fuel cells. The SECA program participants are showing progress in the design of fuel cell systems, including the power electronics elements.

Conclusions

The partnerships involved in the development of power electronics for solid oxide fuel cells are succeeding in their research. While there is still much to be accomplished, this progress is quite promising.